Notice of Allowability	Application No.	Applicant(s)	
	09/814,308	PHILLIPS, ALAN PAUL ROLLESTON	
	Examiner	Art Unit	
	Beth Van Doren	3623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the after-final communications of 4/3/2007*.

2. ☒ The allowed claim(s) is/are *18-26 and 30-35*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20070403* .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

TARIQ R. HAFIZ
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3600

DETAILED ACTION

1. The following action is a response to the after final communications of 04/03/2007. Claims 18, 24-26, and 31-33 have been amended by examiner's amendment. Further, claims 27-29 have been canceled and claim 35 has been added by examiner's amendment. Claims 18-26 and 30-35 are now pending in this application and are allowed. This action includes an examiner's amendment and reasons for allowance

Examiner's Amendment

2. An examiner's amendment to the record appears below. Should the changes be unacceptable to the applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Michael Dunnam on April 3, 2007. The application has been amended as follows:

In the claims:

Please amend claim 18 as follows:

18. A method of controlling a system to optimize an objective function thereof, the system ~~being capable of~~ performing a plurality of candidate actions and ~~being capable of~~ monitoring response performances of a performance of a respective candidate action, where the objective function is a function of the monitored response performances following decisions and actions taken, the method comprising the steps of:

a) monitoring response performance of a respective candidate action that is chosen to be performed by the system;

b) storing, according to the candidate action performed by the system, a representation of said monitored response performance;

c) calculating the expected growth in regret associated with each of the plurality of candidate actions, assessed using a probability distribution based on the historical response performances to date of said plurality of candidate actions, where the expected growth in regret is a system performance measure that is calculated to represent the trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring one of said one or more apparently non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action, based on said historical response performances to date;

~~c~~d) choosing as the next action ~~which of~~ the ~~plurality of~~ candidate actions that is calculated to result in the lowest expected growth in regret after the chosen candidate action is performed ~~next performed~~ by the system ~~so as to optimize said objective function by assessing, using the probability distribution of the response performance of all of said plurality of candidate actions, which candidate action is estimated to result in the lowest expected growth in regret after the chosen candidate action is performed by the system~~;

~~d~~e) commanding the system to perform the chosen next ~~candidate~~ action ~~identified to be the next performed in step c)~~; and

~~e~~f) repeating steps a) to ~~d~~e) to control the system so as to substantially optimize the objective function of the system~~;~~

~~where regret is a term that represents a system performance measure that considers the relative merit of exploration of one or more apparently non-best candidate actions, with respect to the relative merit of exploiting what appears to be the current best candidate action based on historical response performances to date~~.

Please amend claim 24, line 3, as follows:

~~f~~g) applying a temporal depreciation factor to the stored representations of the

Please amend claim 25, line 1, as follows:

25. A method according to claim 24 wherein step ~~f~~g)

Please amend claim 26, line 3, as follows:

~~f~~g) forcing the performance of each candidate action a minimum number of times

Please cancel claims 27-29.

Please amend claim 31 as follows:

31. A system having means for performing a plurality of candidate actions and means for monitoring response performances of a performance of a respective candidate action during performance of an objective function of the system, where the objective function is a function of the monitored response performances following decisions and actions taken, the system further having a control apparatus that is programmed to control the objective function of the system ~~according to the method of claim 18~~ by performing the method comprising the steps of:

a) monitoring response performance of a respective candidate action that is chosen to be performed by the system;

b) storing, according to the candidate action performed by the system, a representation of said monitored response performance;

c) calculating the expected growth in regret associated with each of the plurality of candidate actions, assessed using a probability distribution based on the historical response performances to date of said plurality of candidate actions, where the expected growth in regret is a system performance measure that is calculated to represent the trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring one of said one or more apparently non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action, based on said historical response performances to date;

d) choosing as the next action the candidate action that is calculated to result in the lowest expected growth in regret after the chosen candidate action is performed;

e) commanding the system to perform the chosen next action; and

f) repeating steps a) to e) to control the system so as to substantially optimize the objective function of the system.

Please amend claim 32 as follows:

32. A robot comprising the system according to claim 31, where the ~~system comprises a robot~~ control apparatus of the system controls the objective function of the robot so as to optimize the objective function of the robot.

Please amend claim 33 as follows:

33. A control apparatus for controlling a system to optimize an objective function thereof, the system ~~being capable of~~ performing a plurality of candidate actions and ~~being capable of~~ monitoring response performances of a performance of a respective candidate action, where the objective function is a function of the monitored response performances following decisions and actions taken, the control apparatus comprising ~~programmed to perform the steps of~~:

a) means for monitoring response performance of a respective candidate action that is chosen to be performed by the system;

b) means for storing, according to the candidate action performed by the system, a representation of said monitored response performance;

c) means for calculating the expected growth in regret associated with each of the plurality of candidate actions, assessed using a probability distribution based on the historical response performances to date of said plurality of candidate actions, where the expected growth in regret is a system performance measure that is calculated to represent the trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring one of said one or more apparently non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate

action but which in fact may not be the current best candidate action, based on said historical response performances to date; and

~~c~~d) means for choosing as the next action ~~which of~~ the ~~plurality of~~ candidate actions that is calculated to result in the lowest expected growth in regret after the chosen candidate action is performed ~~next performed~~ by the system ~~so as to optimize said objective function by assessing, using the probability distribution of the response performance of all of said plurality of candidate actions, which candidate action is estimated to result in the lowest expected growth in regret after the chosen candidate action is performed by the system~~;

~~d~~e) means for commanding the system to perform the chosen next ~~candidate~~ action, ~~identified to be the next performed in step c); and~~

~~e repeating steps a) to d to control~~ wherein the control apparatus controls the system so as to substantially optimize the objective function of the system~~;~~

~~where regret is a term that represents a system performance measure that considers the relative merit of exploration of one or more apparently non-best candidate actions, with respect to the relative merit of exploiting what appears to be the current best candidate action based on historical response performances to date~~.

Please add claim 35 as follows:

35. A method of controlling a system with two or more subsystems to optimize an objective function of the system, the system performing a plurality of candidate actions, wherein a candidate action is represented by the selection of a lower level subsystem from said two or more subsystems, and wherein the system monitors the response performance of the selected subsystem, where the objective function is a function of the monitored response performances following decisions and actions taken, the method comprising the steps of:

a) monitoring response performance of a respective candidate action that is chosen to be performed by the system;

b) storing, according to the candidate action performed by the system, a representation of said monitored subsystem performance in response to the candidate action;

c) calculating the expected growth in regret associated with each of the plurality of candidate actions, assessed using a probability distribution based on the historical response performances to date of said plurality of candidate actions, where the expected growth in regret is a system performance measure that is calculated to represent the trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring one of said one or more apparently non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action, based on said historical response performances to date;

d) choosing as the next action the candidate action that is calculated to result in the lowest expected growth in regret after the chosen candidate action is performed by the system;

e) commanding the system to perform the chosen next action using a corresponding lower level subsystem; and

f) repeating steps a) to e) to control the system so as to substantially optimize the objective function of the system.

Reasons for Allowance

3. Claims 18-26 and 30-35 are allowed.

4. The following is an examiner's statement of reasons for allowance: None of the prior art of record, taken individually or in any combination, teach, inter alia, iteratively repeating the steps of calculating the expected growth in regret associated with each of the plurality of candidate actions as a trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring a

non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action and then choosing and performing a next candidate action that is calculated to result in the lowest expected growth in regret after the chosen candidate action is performed.

The prior art references most closely resembling the Applicant's claimed invention are Merriman et al. (U.S. 2002/0099600), Eppen et al. (Quantitative Concepts for Management), Masch (U.S. 5,930,762), McClave et al. (A First Course in Business Statistics), Jameson (U.S. 6,032,123), Strickland et al. (U.S. 5,790,407)

Merriman et al. teaches that the response performance to a candidate action (advertising) is monitored and stored in the historical database of the system. Based on the knowledge gained and stored concerning response performance, a next action (ad) is chosen to be performed by the system to optimize an objective function by assessing, using a predictive model, empirical data to determine which action will maximize feedback/minimize economic loss after the chosen candidate action is performed based on historical response performances to date by the system. This is an iterative process, where the model is refined over time. However, Merriman et al. does not explicitly disclose that this minimizing of economic loss is in terms of regret or calculating the expected growth in regret as a trade-off between the relative merit of exploration of one or more apparently non-best candidate actions with respect to the relative merit of exploiting what appears to be the current best candidate action.

Eppen et al. teaches the concept of regret theory utilized in economic and decision theory, where each possible decision (or action) has associated states of nature

(outcomes). Therefore, in each set of possible decisions (or actions), an action is associated with an apparently best outcome and another action is associated with an apparently non-best outcome. They are the apparent best and non-best outcomes because they have not yet occurred. Epen et al. disclose the generation of a regret table where regret is expressed as a performance measure, and the table shows the merit (i.e. value, advantage, worth) of exploring a non-best action (decision) versus the merit of exploiting a best action (decision), as represented by the numbers in the table that reflect opportunity cost/loss. Finally, Eppen et al. specifically discusses that when the decision maker/software knows the probability distribution on the state of nature, regret can be minimized. However, Eppen et al. does not explicitly disclose calculating the expected growth in regret as a trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring a non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action.

Masch discloses a computer system that aides a user in making decisions under conditions of uncertainty. Masch uses models to find, analyze, and fine-tune tradeoffs and to construct alternative candidate strategies. A constructed strategy is then selected for implementation in the physical system based on decision analysis including the use of regret methods and matrices. Regret-based methods compare candidate strategies in an attempt to minimize the negative impact of uncertainty. The comparison leads to the output of a regret matrix that represents the payoffs of potential outcomes of each candidate strategy as well as a regret estimate that represents the opportunity loss of the

strategy if it turns out to not be the best scenario. Therefore, while Masch disclose using regret analysis to choose a candidate strategy to implement in a system and a chosen strategy turning out to not be the best (in terms of regret), Masch does not explicitly teach a tradeoff calculation that includes the merit of exploration of a non-best candidate action based on the risk of it actually being the best candidate action after its performance. In all of Masch's examples, Masch always chooses the candidate strategy that is expected to result in the lowest regret based on currently known data (before an action is performed). Thus, Masch does not explicitly disclose iteratively repeating the steps of calculating the expected growth in regret as a trade-off between the relative merit of exploration of one or more apparently non-best candidate actions to mitigate the risk of ignoring a non-best candidate actions which may actually be the current best candidate action, with respect to the relative merit of exploiting what appears to be the current best candidate action but which in fact may not be the current best candidate action.

Finally, McClave et al., Jameson, and Strickland et al. teach various features of the claimed invention. These prior arts teach determining the sample size needed to make reliable decisions, using a Monte Carlo algorithm to provide understanding using "what if" simulation, and controlling external devices, such as robots, by comparing the response profile of the device to the actual response of the device, respectively. However, none of McClave et al., Jameson, and Strickland et al. disclose regret calculations or calculating the expected growth in regret as a trade-off between the relative merit of exploration of one or more apparently non-best candidate actions with respect to the relative merit of exploiting what appears to be the current best candidate action.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement for Reasons for Allowance".

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Dembo (U.S. 5,148,365) discloses scenario optimization and using probability values to determine the expectancy that a scenario will occur.

Masch (WO 98/13776) discloses candidate strategy considerations using regret theory.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Beth Van Doren whose telephone number is 571-272-6737. The examiner can normally be reached on M-F, 8:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tariq Hafiz can be reached on 571-272-6729. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

bvd
April 4, 2007

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